RS&H

August 2024

I-4 (SR 400) Master Plan Study
from West of SR 570 (Polk Parkway) to West of US 27
FPID: 442512-1-12-01
Facility Operations and Preservation Element Report

Facility Operations and Preservation Element Report

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Polk County, Florida
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1 Introduction

Interstate 4 (I-4) functions as the primary artery for vehicular traffic traveling east/west across central Florida. The I-4 corridor connects Tampa and Orlando while also serving the residents of Lakeland and other adjacent areas of Polk County.

1.1 Study Description

The Florida Department of Transportation (FDOT) District One office has initiated the development of a Master Plan for I-4 throughout the District to determine improvement strategies that will meet future safety, operational, and capacity needs of this critical link in Florida's Strategic Intermodal System (SIS). I-4 supports tourism, economic development, emergency management, and the mobility of people and goods throughout the middle part of the state and is an important evacuation route in the event of a natural disaster. The project Purpose and Need is to address existing operational deficiencies and improve safety of I-4 within Polk County, accommodate future travel demand and maintain regional mobility, while enhancing emergency evacuation and response times.

This project is located along I-4 from west of SR 570 (Polk Parkway) west interchange to west of the US 27 interchange. The PD&E Study spans 27.6 miles in length and traverses the cities of Lakeland, Polk City, and Auburndale in Polk County. The Project Location Map is shown in Figure 1-1.

The study area includes seven existing service interchanges on I-4 and two system interchanges at I- 4 and Polk Parkway. The on- and off-ramps and merge/diverge areas for the existing interchanges are located along I-4 and/or Polk Parkway. The interchanges are listed below, from west to east:

- I-4 and SR 570 (Polk Parkway) System-to-System Interchange
- I-4 and US 92/SR 546 (West Memorial Boulevard)
- I-4 and SR 539 (Kathleen Road)
- I-4 and US 98/SR 35/SR 700
- I-4 and CR 582 (North Socrum Loop Road)/SR 33 (Lakeland Hills Boulevard)
- I-4 and SR 33 (Lakeland Hills Boulevard/Commonwealth Avenue)
- I-4 and SR 570 (Polk Parkway) System-to-System Interchange
- I-4 and SR 559
- I-4 and SR 557

Figure 1-1: Project Location Map (1 of 3)

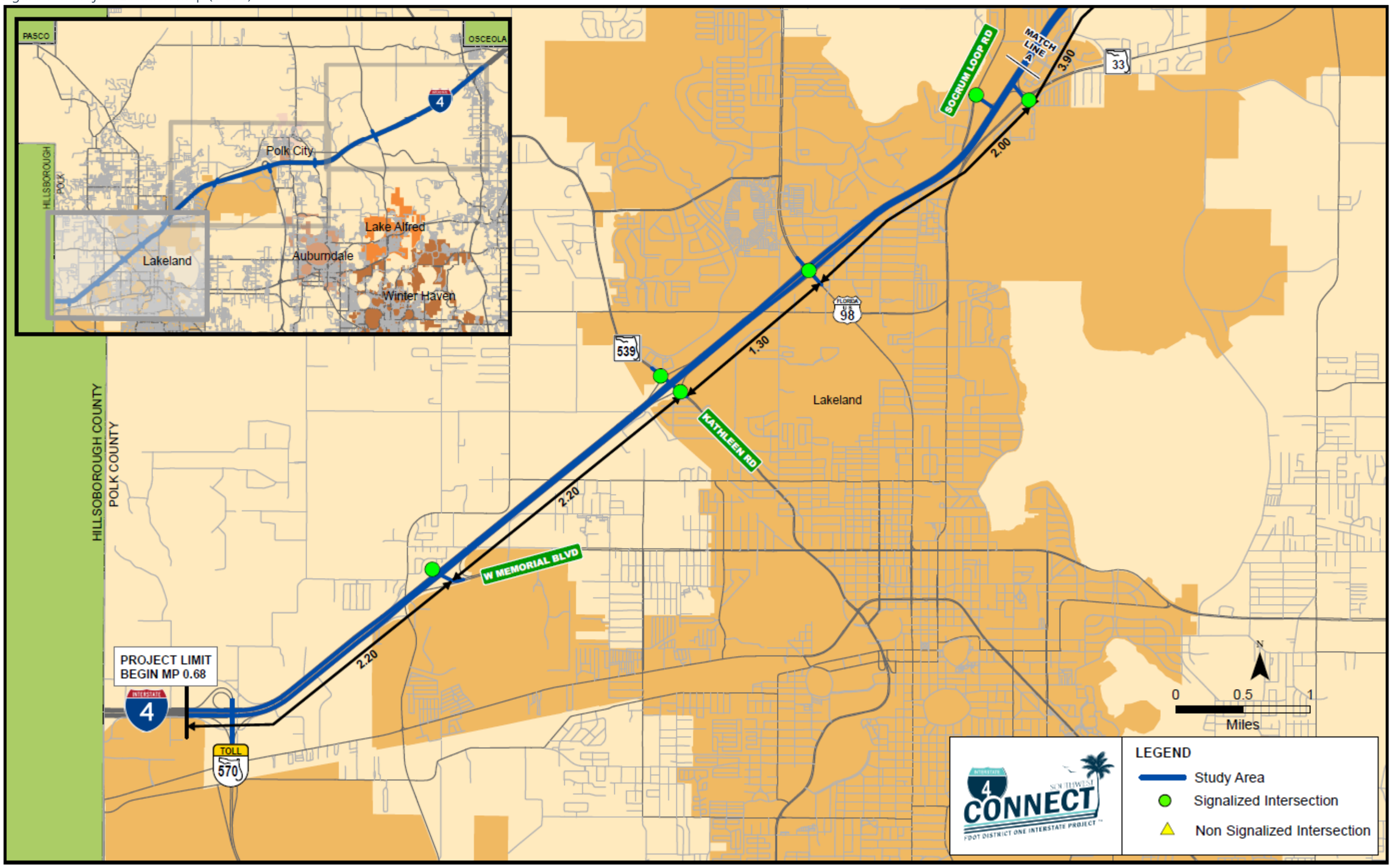


Figure 1-2: Project Location Map (2 of 3)

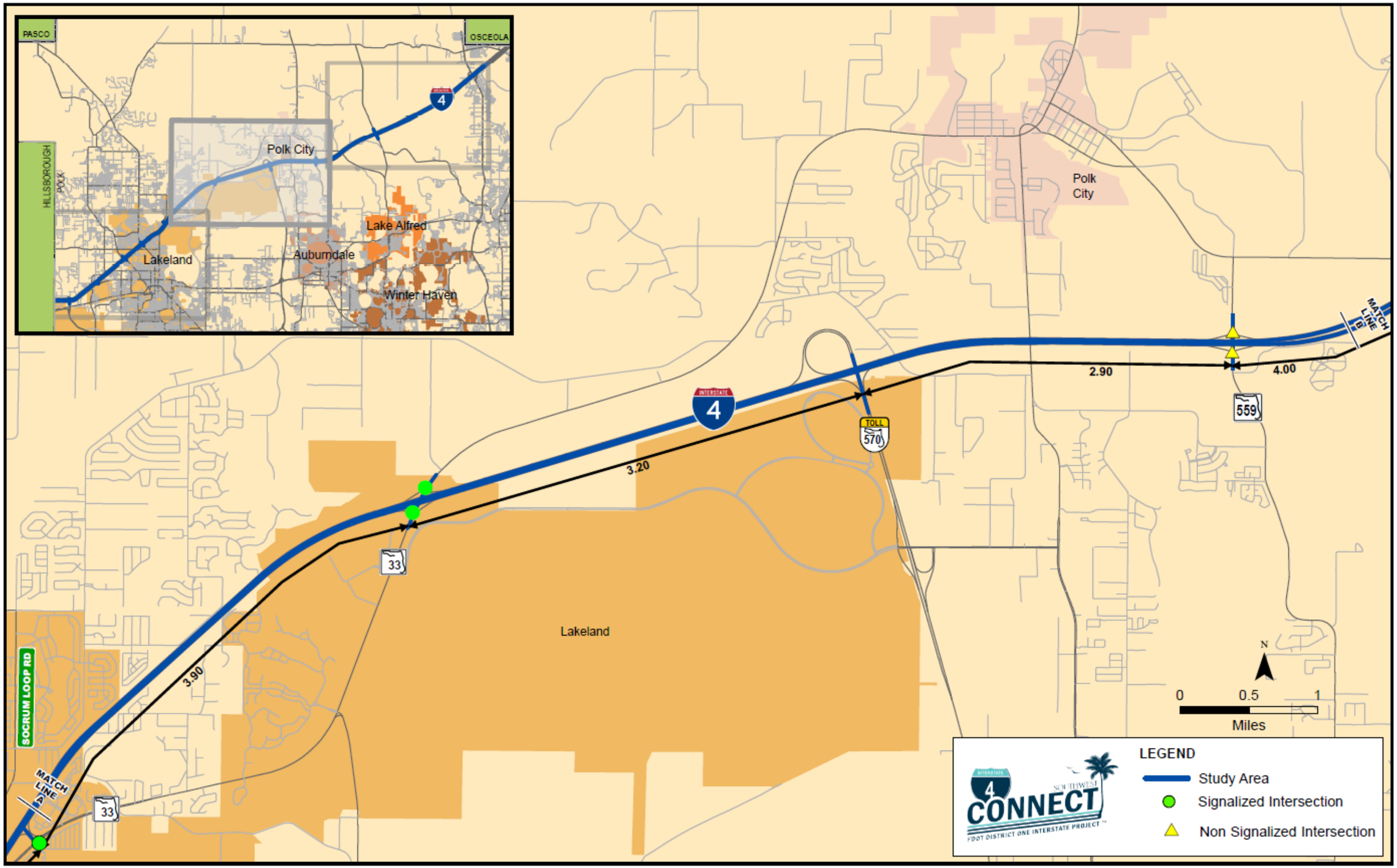


Figure 1-3: Project Location Map (3 of 3)

1.2 Purpose of Report

This report documents the physical and management improvements recommended to preserve and extend, where possible, the existing acceptable level of service (LOS) until the ultimate improvements can be made or to improve the LOS where it is currently below LOS targets. Roadway components that are anticipated to fail in future years will be addressed with short-term or ultimate improvements in a future PD&E study.

This report contains an analysis of traffic growth, recommendations of Transportation Systems Management and Operations (TSM&O) techniques, and interim capacity preservation measures recommended throughout the study period. Strategies considered include preservation of capacity of the I-4 mainline, interchange ramp connections, ramp terminal intersections, and cross streets. In addition, improvements were evaluated to address inadequate sight distance, crash hot spots, and bicycle/pedestrian safety. Existing conditions were initially identified using Google Streetview and confirmed with field reviews on May 3, 2024 and July 17, 2024.

2 Year of Failure

The Revised Draft Build Alternatives Traffic Analysis Memo (May 2023, **Appendix A**) includes a No-Build Year of Failure Traffic Analysis that identifies the year when individual I-4 mainline segments and ramp terminal intersections are expected to no longer meet the established FDOT Level of Service (LOS) D target without improvements. Tables 22 and 23 of the Revised Draft Build Alternatives Traffic Analysis Memo include 2045 No-Build LOS, Density and other MOEs for the eastbound and westbound I-4 segments, respectively. Tables 24 and 25 include 2045 No-Build LOS and queue lengths for the intersections.

The No-Build Alternative includes currently planned and programmed improvements or projects with construction phases identified in cost feasible plans, including the following:

- I-4 interchange improvements at CSX Railroad (bridge replacement).
- SR 33 interchange: reconstruction with roundabout intersections and widening of SR 33 to four lanes.
- SR 559 interchange: signalize ramp terminals (2024).
- SR 557 interchange: reconstruct with roundabouts at ramp terminals (completed).

Year of Failure for Ramp Terminal Intersections

For the No-Build Alternative, the annual growth rate is 1.91% along I-4 corridor from the existing conditions to the design year (2045) conditions. Traffic volumes for interim years were calculated by reducing the design year volumes by 1.91% per year. The growth/reduction factor under Synchro and SIDRA software was used to adjust traffic volumes for each interim year. In the case that traffic operations are anticipated to fail by the design year, an iterative traffic analysis was performed to determine the year when traffic starts to operate below LOS D. The summary of years of failure for ramp terminals are illustrated in Table 2-1 (Table 26 from Revised Draft Build Alternatives Traffic Analysis Memo, May 2023).

Table 2-1: Year of Failure Analysis – Ramp Terminal Intersections

Intersection	Existing (2022)			No-Build (2045)			Year of Failure
		Overall LOS (Delay)			Overall LOS (Delay)		
	Intersection Type	AM	PM	Intersection Type	AM	PM	
West Memorial Boulevard & I-4 Westbound	Signalized[1]	B (13.0)	B (12.7)	Signalized[1]	B (18.5)	B (19.3)	NA
Kathleen Road (SR 539) & I-4 Westbound	Signalized[1]	C (26.9)	C (22.1)	Signalized[1]	C (29.7)	C (33.8)	NA
Kathleen Road (SR 539) & I-4 Eastbound	Signalized[1]	B (18.7)	C (24.8)	Signalized[1]	C (27.5)	C (28.8)	NA
US-98 & I-4	Signalized[1]	D (51.5)	E (55.1)	Signalized[1]	F (86.1)	E (66.1)	2034
North Socrum Loop Road (CR 582) & I-4 Westbound	Signalized[1]	E (61.2)	D (43.4)	Signalized[1]	F (99.9)	F (106.4)	2035
Lakeland Hills Boulevard & I-4 Eastbound	Signalized[1]	D (40.3)	F (80.3)	Signalized[1]	F (129.5)	F (124.4)	2022
SR 33 & I-4 Westbound	Signalized[1]	C (26.3)	C (24.7)	Roundabout[3]	A (6.2)	B (10.1)	NA
SR 33 & I-4 Eastbound	Signalized[1]	C (23.5)	F (97.6)	Roundabout[3]	B (13.8)	C (21.6)	NA
SR 559 & I-4 Westbound	Non-Signalized[2]	F (>999)	F (732.5)	Signalized[1]	E (58.0)	D (46.2)	2044
SR 559 & I-4 Eastbound	Non-Signalized[2]	E (43.6)	C (22.4)	Signalized[1]	C (28.1)	C (26.9)	NA
SR 557 & I-4 Westbound	Non-Signalized[2]	F (896.3)	F (>999)	Roundabout[3]	F (110.4)	F (119.8)	2034
SR 557 & I-4 Eastbound	Non-Signalized[2]	F (198.1)	F (185.7)	Roundabout[3]	C (15.8)	F (70.3)	2035

Synchro Version 11 Build 168

LOS Notes:

Delay is in sec/veh units

:Level Of Service (LOS) E reflecting at capacity operations

:Level Of Service (LOS) F reflecting over capacity operations

Results

1 :Synchro

2 :HCS

3 :SIDRA

1. All the signal timings have been optimized for splits and offsets. The signal phase for right turn movements have been maintained based on existing signal phasing.
2. Synchro does not account for queue spillover effects. Queue lengths from Synchro would not be realistic, especially for future conditions analysis to account for the spill back. Off-ramp queues based on 2045 No-Build Alternative are documented in Appendix H of the Revised Draft Build Alternatives Traffic Analysis Memo.

The following ramp terminals are anticipated to operate at an acceptable LOS D or better by Design Year 2045 under No-Build Alternative:

- I-4 and US 92/SR 546 (West Memorial Boulevard)
- I-4 and SR 539 (Kathleen Road)
- I-4 and SR 33 (roundabout)
- I-4 and SR 559 Eastbound Ramp terminal

The list of interchanges with the Year of Failure are stated below:

- I-4 and US 98/SR 35/SR 700 – **Year 2034**
- I-4 and CR 582 (North Socrum Loop Road)/SR 33 (Lakeland Hills Boulevard) – **Year 2022**
- I-4 and SR 559 Westbound Ramp Terminal – **Year 2044**
- I-4 and SR 557 westbound ramp terminal roundabout – **Year 2034** and eastbound ramp terminal roundabout – **Year 2035**

Mainline and Ramp Lane Requirements

Future lane requirements were evaluated to provide an estimated timeline for the onset of capacity deficiencies along the I-4 corridor. Freeway mainline LOS targets were based on the 2023 FDOT Quality/LOS Handbook and adjusted based on a traffic composition of 7% trucks. Capacity analysis for ramp roadways was based on adjusted targets from the HCM 6th Edition. Worst-case volumes during AM or PM peak hours were considered for this planning level analysis.

Table 2-2 (Table 30 from Revised Draft Build Alternatives Traffic Analysis Memo, May 2023) shows the detailed color-coded future lane requirements corresponding to LOS D (maximum service volume) for No-Build for the freeway mainline:

- I-4 mainline segments at SR 570 (West Polk Parkway) is projected to operate at deficient levels of service by year 2034 and need for 10-lanes roadway improvement.
- I-4 mainline segments at West Memorial Boulevard is projected to be deficient by year 2039 and need for 10-lanes roadway improvement.
- I-4 mainline segments at US 98/SR 35/SR 700 is projected to be deficient by year 2045 and need for 10-lanes roadway improvement.
- I-4 mainline segments from CR 582 (North Socrum Loop road) to SR 557 (East Polk Parkway) are projected to be deficient and need for 10-lanes roadway beyond year 2045.
- Single lane exit and entry ramps are anticipated to operate at acceptable levels of service up to the Design Year 2045 for No-Build conditions.

Table 2-2: I-4 Lane Requirements by Year for No-Build Alternative (Total Demand)

Milepost – Location	I-4 Corridor	Traffic Count	Interpolated Volumes																						Design Year
		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
		4510	4630	4750	4870	4990	5110	5230	5350	5470	5590	5710	5830	5960	6080	6200	6320	6440	6560	6680	6800	6920	7040	7160	7280	7400
SR 557		460	490	510	540	570	600	620	650	680	700	730	760	790	810	840	870	890	920	950	970	1000	1030	1060	1080	1110
		340	360	370	390	410	420	440	460	470	490	510	520	540	560	570	590	610	620	640	660	670	690	710	720	740
		4420	4530	4640	4750	4860	4970	5090	5200	5310	5420	5530	5640	5750	5860	5970	6080	6190	6300	6420	6530	6640	6750	6860	6970	7080
SR 559		510	520	530	540	550	560	570	570	580	590	600	610	620	630	640	650	660	670	680	680	690	700	710	720	730
		520	530	540	550	560	570	580	590	600	610	620	630	640	650	660	670	680	690	700	710	720	730	740	750	760
		4430	4540	4650	4760	4870	4970	5080	5190	5300	5410	5520	5630	5740	5840	5950	6060	6170	6280	6390	6500	6610	6710	6820	6930	7040
SR 570 (Polk Parkway)		260	290	330	360	400	430	470	500	530	570	600	640	670	700	740	770	810	840	880	910	940	980	1010	1050	1080
		280	290	310	320	340	350	370	380	400	410	430	440	460	470	480	500	510	530	540	560	570	590	600	620	630
		4450	4540	4630	4720	4810	4900	4990	5070	5160	5250	5340	5430	5520	5610	5700	5790	5880	5970	6060	6140	6230	6320	6410	6500	6590
SR 33 (Lakeland Hills Boulevard/Commonwealth Avenue)		350	360	370	380	390	400	410	420	430	440	450	460	480	490	500	510	520	530	540	550	560	570	580	590	600
		730	740	750	760	770	780	790	800	810	820	830	840	850	860	870	880	890	900	910	920	930	940	950	960	970
		4540	4640	4740	4850	4950	5050	5150	5250	5360	5460	5560	5660	5770	5870	5970	6070	6170	6280	6380	6480	6580	6680	6790	6890	6990
SR 33 (Lakeland Hills Boulevard/Commonwealth Avenue)		360	370	390	400	420	430	450	460	480	490	510	520	540	550	560	580	590	610	620	640	650	670	680	700	710
		860	870	880	890	900	910	920	930	940	950	960	970	990	1000	1010	1020	1030	1040	1050	1060	1070	1080	1090	1100	1110
CR 582 (North Socrum Loop Road)		440	450	460	470	490	500	510	520	530	540	550	560	580	590	600	610	620	630	640	650	670	680	690	700	710
		810	820	840	850	860	870	890	900	910	920	940	950	960	970	990	1000	1010	1020	1040	1050	1060	1070	1090	1100	1110
		4910	5010	5120	5220	5330	5430	5540	5640	5740	5850	5950	6060	6160	6260	6370	6470	6580	6680	6790	6890	6990	7100	7200	7310	7410
US 98/SR 35/SR 700		620	630	640	650	660	660	670	680	690	700	710	720	730	730	740	750	760	770	780	790	800	800	810	820	830
		950	960	970	980	990	1000	1010	1010	1020	1030	1040	1050	1060	1070	1080	1090	1100	1110	1120	1120	1130	1140	1150	1160	1170
		5240	5340	5450	5550	5660	5760	5870	5970	6080	6180	6290	6390	6500	6600	6700	6810	6910	7020	7120	7230	7330	7440	7540	7650	7750
SR 539 (Kathleen Road)		650	660	670	670	680	690	700	700	710	720	730	730	740	750	760	760	770	780	790	790	800	810	820	820	830
		560	570	580	590	600	610	620	620	630	640	650	660	670	680	690	700	710	720	730	730	740	750	760	770	780
		5200	5300	5410	5510	5620	5720	5830	5930	6030	6140	6240	6350	6450	6550	6660	6760	6870	6970	7080	7180	7280	7390	7490	7600	7700
West Memorial Boulevard		290	300	300	310	320	320	330	340	340	350	360	360	370	380	380	390	400	400	410	420	420	430	440	440	450
		740	760	790	810	830	860	880	900	930	950	970	1000	1020	1040	1070	1090	1110	1140	1160	1180	1210	1230	1250	1280	1300
		5600	5720	5850	5970	6090	6210	6340	6460	6580	6700	6830	6950	7070	7190	7320	7440	7560	7680	7810	7930	8050	8170	8300	8420	8540
		480	490	500	510	530	540	550	560	570	580	590	600	620	630	640	650	660	670	680	690	710	720	730	740	750
SR 570 (Polk Parkway)		840	860	890	910	940	960	990	1010	1040	1060	1090	1110	1140	1160	1180	1210	1230	1260	1280	1310	1330	1360	1380	1410	1430
		5960	6100	6230	6370	6500	6640	6770	6910	7040	7180	7310	7450	7580	7720	7850	7990	8120	8260	8390	8530	8660	8800	8930	9070	9200

Note: MSV - Maximum Service Volumes

LOS D service volumes were adjusted for 7% Trucks

Number of Mainline Lanes by LOS D Maximum Service Volume (MSV)	
Lanes	LOS D
2	N/A
3	5,800
4	7,700
5	9,600

Source: Adjusted MSV based on HCM 6th Edition

Number of Ramp Lanes by Capacity (LOS D MSV)	
1	1,680
2	3,360

Free Flow Speed 40 mph - 50 mph

Source: Adjusted MSV based on HCM 6th Edition

Number of Ramp Lanes by Capacity (LOS D MSV)	
1	1,520
2	3,040

Free Flow Speed 21 - 30 mph

Source: Adjusted MSV based on HCM 6th Edition

3 Operations Considerations and Recommendations

This section summarizes I-4 segments and interchanges that are currently (Existing Year 2022) operating at an unacceptable LOS. The following tables in the Revised Draft Build Alternatives Traffic Analysis Memo, May 2023 (see **Appendix A**) documents existing and future volumes and MOEs:

- Tables 12 and 13 include Existing Year 2022 hourly demand volumes, freeway and ramp density, LOS, freeway and ramp demand to capacity ratios, and freeway and ramp speeds as well as merge and diverge segment types for basic eastbound and westbound segments and ramps.
- Table 14 includes Existing Year 2022 Intersection volumes, LOS, and queue lengths.
- Figure 13 shows the Build Alternative volumes, LOS (delay), and queues for each ramp terminal intersection movement/approach.

The locations with unacceptable LOS were evaluated for low-cost interim/short-term Transportation Systems Management and Operations (TSM&O) improvements to improve operations until long-term ultimate improvements can be made. TSM&O improvements include additional turn lanes at intersections, auxiliary lanes, and deceleration lanes. Segments or intersections that fail in later years will be addressed by ultimate improvements or will be evaluated for interim/short-term improvements in a future PD&E study.

Several segments and interchanges are currently operating at an acceptable LOS (LOS D or better). Generally, enhanced ITS systems such as queue detection, Variable Message Signs (VMS), and All Electronic Tolling will help preserve and improve overall operations by warning drivers of crashes and stopped or slow traffic, providing route guidance, and allowing tolls to be collected without vehicles having to stop at toll plazas. Signal timings should be reevaluated to preserve or extend the acceptable LOS of operations. Timely removal of debris from the roadway and other maintenance such as replacing faded pavement stripes, inoperable lighting, and damaged signs is also expected to improve safety. In addition, other short-term improvements such as additional turn lanes, longer turn lanes, and auxiliary lanes should be evaluated where needed and where they can be accommodated within existing right-of-way and accommodate the ultimate improvements without being removed.

All of the specific recommended improvements preserve a 44-foot envelope for a potential future passenger rail expansion, to be located within the I-4 median. All of the proposed capacity improvement recommendations are anticipated to operate at an acceptable LOS D or better until Design Year 2045 as part of the ultimate Build Alternative with two Express Lanes in each direction. These recommendations were not evaluated separately without the Express Lanes. In addition, the analysis is subject to change based on future PD&E traffic analysis and methodology.

3.1 Operations Considerations and Recommendations for Interchanges and Ramp Terminals

Recommendations for interim improvements to improve failing LOS are based on traffic operations. Concept plan sheets for the operations recommendations are included in **Appendix B**. Estimated construction costs for the recommended improvements are based on FDOT per-mile planning cost models and are included in **Appendix C.** Potential improvements in other areas where existing year 2022 LOS fails to meet the acceptable target of LOS D are suggested for consideration and evaluation in a future PD&E study. Concept sketches for these potential improvements are included in **Appendix D**. Some of these areas require detailed evaluations to address challenges such as constrained right-of-way, alignment, concrete pavement, cross slopes, and conflicts with adjacent bridge structures and existing loop ramps. Therefore, cost estimates were not prepared.

3.1.1 SR 570/Polk Parkway West

Currently there are four eastbound lanes on I-4 approaching the two-lane off-ramp to the SR 570/Polk Parkway West interchange. The outside lane along I-4 drops onto the ramp and the other lane (choice lane) splits to either continue along eastbound I-4 or exit to SR 570/Polk Parkway. The existing LOS for the off-ramp is LOS B and LOS F in the AM and PM, respectively. The ultimate improvements (with Express Lanes) will be needed to fully address these deficiencies.

A choice lane helps to reduce lane-changing activities. While an interim additional through lane without a choice lane will increase capacity, it may also exacerbate lane-changing activities. Lane geometry alternatives will be evaluated during the PD&E study to determine whether an additional drop lane will benefit traffic flows, or if it creates a weaving issue. South Frontage Road is located adjacent to the eastbound I-4 lanes; therefore, any widening would need to occur in the median. Another consideration is that any widening may be complicated since the existing pavement is concrete, so maintaining acceptable cross slopes and alignment may require full reconstruction of the pavement. Also, the curved mainline alignment east of the interchange may need to be adjusted to avoid or minimize design variations for the ultimate typical section, including general use lanes, express lanes, and the rail corridor in the median.

The I-4 segment between the eastbound off-ramp to Polk Parkway and the on-ramp from Polk Parkway is LOS D and F in the AM and PM, respectively. An interim auxiliary lane can be evaluated in the PD&E study. The space under the existing Polk Parkway bridges over I-4 can accommodate an additional lane along eastbound I-4.

The Polk Parkway on-ramp merge to eastbound I-4 operates at LOS D and LOS F in the AM and PM, respectively. The ultimate improvements (with Express Lanes) will be needed to fully address these deficiencies into the Design Year 2045.

The segment between the westbound off-ramp to Polk Parkway and the on-ramp from Polk Parkway is LOS E and D in the AM and PM, respectively. The Polk Parkway ramp bridges over I-4 can accommodate an additional lane along westbound I-4 to the outside; however, outside widening may impact the westbound loop off-ramp. An interim auxiliary lane can be evaluated in the PD&E study.

There are no at-grade intersections associated with this interchange. Concept sketches for these potential improvements are included in **Appendix D**.

3.1.2 US 92/SR 546/W. Memorial Boulevard

Currently the westbound off-ramp to US 92/SR 546/W. Memorial Boulevard diverges from the I-4 through lane with no parallel deceleration lane. The existing LOS is LOS E and LOS D in the AM and PM, respectively. Based on the Revised Draft Build Alternatives Traffic Analysis Memo (5/31/23), it is recommended that a 1,500-foot parallel deceleration lane be evaluated to improve the LOS for this diverge segment to LOS C (with Express Lanes) during AM and PM, respectively, through Design Year 2045 (with Express Lanes). The Swindell Road overpass can accommodate an additional deceleration lane. While the parallel deceleration lane is part of the ultimate improvements (with Express Lanes) it could be phase-constructed early to improve the existing LOS. The construction cost is estimated to be $361,243 (See **Appendix C**).

Currently the eastbound off-ramp to US 92/SR 546/W. Memorial Boulevard diverges from the I-4 through lane with no deceleration lane. The existing LOS is LOS E and LOS F in the AM and PM, respectively. The ultimate improvements (with Express Lanes) will be needed to fully address these deficiencies. The South Frontage Road and North Galloway Road bridge pier constrains options to widen to the outside for an interim 1,500-foot auxiliary lane. However, an 800-foot deceleration lane could be evaluated west of the North Galloway Road overpass, and the ramp realigned under the outside span of the three-span overpass to improve operations. This interim auxiliary lane for the eastbound exit ramp can be evaluated in a future PD&E study (**Appendix D**).

3.1.3 SR 539/Kathleen Road

Currently the westbound off-ramp to SR 539/Kathleen Road diverges from the I-4 through lane with no parallel deceleration lane. The diverge operates at LOS E and LOS D in the AM and PM, respectively. Based on the Revised Draft Traffic Analysis Memorandum (5/31/23), a 1,500-foot deceleration lane is recommended to improve the LOS for this diverge segment to LOS C (with

Express Lanes) during AM and PM, respectively, through the Design Year 2045 (See **Appendix A**). The cost of the deceleration lane is estimated to be $361,243 (**Appendix C**).

The westbound and northbound left turns at the westbound ramp intersection both experience LOS E in the AM. The westbound left turn and the westbound approach both operate at LOS E while the northbound left turn operates at LOS F in the PM.

The eastbound left turn at the eastbound ramp intersection operates at LOS E in both the AM and PM, with the eastbound approach at LOS E in the PM. The southbound left turn also operates at LOS E in the PM.

The ramp terminal intersections can be further evaluated during a PD&E study to determine if any appropriate short-term improvements will improve operations.

3.1.4 US 98

The eastbound, northbound, and southbound left turns experience LOS F in the AM, while the westbound left turns experience LOS E. The eastbound and westbound approaches experience LOS F and E in the AM, respectively.

The eastbound and southbound left turns and the eastbound approach all experience LOS F and the northbound left turns experience LOS E in the PM. In addition, the overall intersection operates at LOS E in the PM, respectively.

Based upon the Vissim analysis documented in the Vissim Analysis Report (March 2024) in **Appendix E**, if no improvements are implemented along US 98, traffic operations are anticipated to deteriorate extensively and cause undue delays by the year 2045. After iterative tests with incremental geometric improvements in the Vissim model, the recommended lane geometry with realistic turn lane improvements for ramp terminals is illustrated in Figure 3-2 (Vissim Analysis Report Figure 8). The recommended additional left turn lane from the eastbound off-ramp to northbound US 98 is based on traffic operations analyses, and further analysis during the PD&E study will be completed. The construction cost of the additional left turn lane is estimated to be $197,695 (See **Appendix C**).

The Vissim analysis focused on proposing required lane geometry improvements only at the ramp terminals. Deficiencies at intersections away from ramp terminals will also be addressed in the PD&E phase. While these recommendations from the Vissim Analysis Report include the ultimate improvements, including two express lanes in each direction along I-4, the added turn lane at the eastbound off-ramp can be phase-constructed early to improve the existing LOS without affecting the I-4 mainline.

Note: Future signal timings have been optimized for splits and offsets based on approved methodology. No improvement was assumed under No-Build condition.

3.1.5 SR 33/Lakeland Hills Boulevard and North Socrum Loop Road

3.1.5.1 North Socrum Loop Road (Westbound Ramps)

The northbound off-ramp and southbound left turns from the driveway at the westbound ramp intersection with North Socrum Loop Road both operate at LOS E, while the northbound off-ramp through movement operates at LOS F in the AM. The northbound off-ramp approach operates at LOS F and the overall intersection is LOS E in the AM.

The westbound Socrum Loop Road left and right turns, westbound Socrum Loop Road approach, and northbound off-ramp left turns all operate at LOS E in the PM.

Based upon the analysis documented in the Vissim Analysis Report (March 2024) in **Appendix E**, if no improvements are implemented along North Socrum Loop Road, traffic operations are anticipated to deteriorate extensively and cause undue delays by year 2045. After iterative tests with incremental geometric improvements in the Vissim model, two alternatives for the recommended lane geometry with realistic turn lane improvements for ramp terminals were identified, with Build Alternative 2 illustrated in Figure 3-2 (Vissim Analysis Report Figure 9) being the Preferred Alternative.

Alternative 2 includes an added left turn lane from the off-ramp onto North Socrum Loop Road southbound and an additional left turn lane from North Socrum Loop Road to the eastbound on-ramp. Since the on-ramp is only one lane, a second receiving lane will need to be added, which is included in the construction cost in **Appendix C.** While the recommendations in the Vissim Analysis Report include ultimate improvements, including two express lanes in each direction along I-4, the added turn lane can be constructed sooner to improve the existing LOS. Note that the recommended lane geometry is based on traffic operations analyses, and further analysis during the PD&E study is needed. The Vissim analysis focused on lane geometry improvements only at the ramp terminals. Deficiencies at intersections away from ramp terminals will also be addressed in the next PD&E phase. The construction cost of the additional left turn lanes and the receiving lane is estimated to be $748,672.

Figure 3-1: Required Lane Geometry at US 98 Ramp Terminals

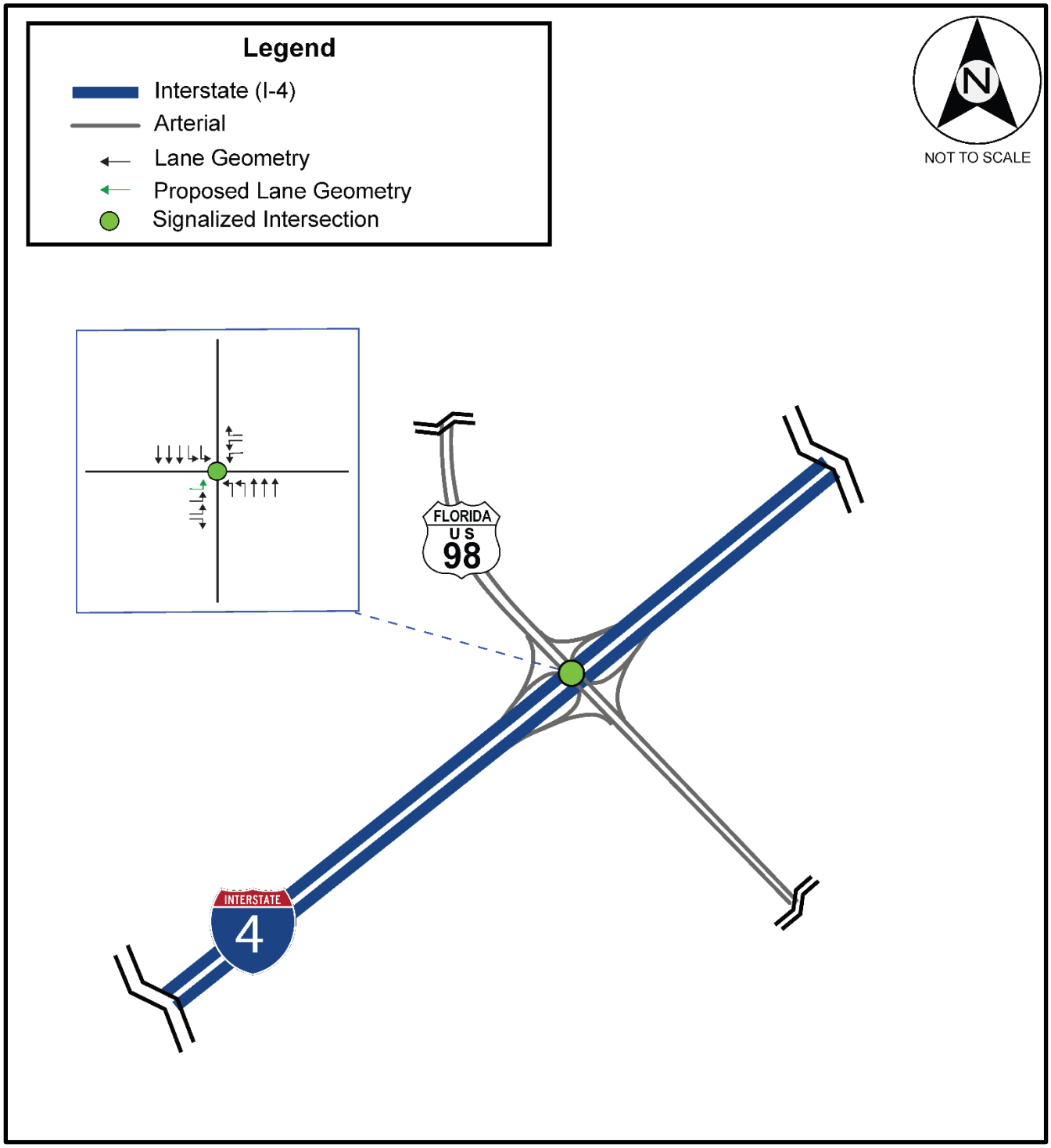
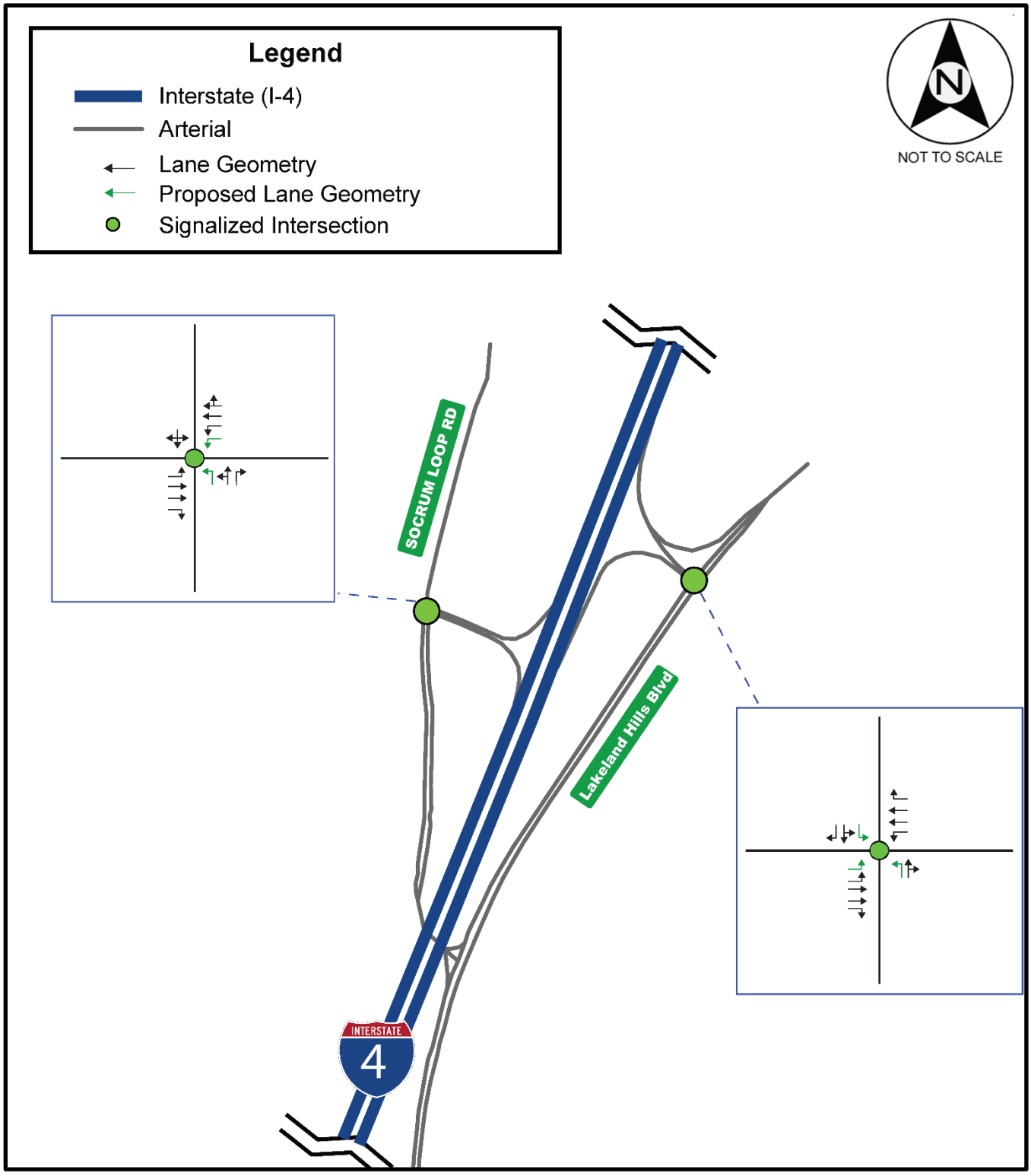


Figure 3-2: Required Lane Geometry at Socrum Loop Rd./Lakeland Hills Blvd. Ramp Terminals



3.1.5.2 SR 33/Lakeland Hills Boulevard (Eastbound Ramps)

The westbound Lakeland Hills Boulevard left turn and southbound off-ramp through movement at the eastbound ramp intersection with SR 33/Lakeland Hills Boulevard both operate at LOS E in the AM.

The northbound Lakeland Harbor Boulevard left turns and through movement, and southbound off-ramp through movements all experience LOS F in the PM. The westbound Lakeland Hills Boulevard left turns experience LOS E in the PM. The northbound Lakeland Harbor Boulevard and southbound off-ramp approaches as well as the overall intersection operate at LOS F in the PM.

Based upon the Vissim analysis documented in the Vissim Analysis Report (March 2024), if no improvements are implemented along Lakeland Hills Boulevard, traffic operations are anticipated to deteriorate extensively and cause undue delays by year 2045. After iterative tests with incremental geometric improvements in the Vissim model, the recommended lane geometry with realistic turn lane improvements is illustrated in Figure 3-2 (Vissim Report Figure 9). Note that proposed lane geometry is based on traffic operations analyses, and further analysis during the PD&E study is needed. The Vissim analysis focused on lane geometry improvements only at ramp terminal. Deficiencies at intersections away from ramp terminals will also be addressed in the next PD&E phase.

The recommended improvements include adding a left turn lane from Lakeland Harbor Boulevard to westbound Lakeland Hills Boulevard and a second left turn lane from the off-ramp to eastbound Lakeland Hills Boulevard **(Appendix B)**. In addition, a second left turn lane is recommended from eastbound Lakeland Hills Boulevard to the I-4 on-ramp which only has one existing receiving lane. Lakeland Hills Boulevard will need to be widened 12 feet to the south side to accommodate the additional turn lane. The lane merge with the westbound Lakeland Hills Boulevard free-flow ramp occurs approximately 400 feet from the intersection. For the purposes of this report, the right turns currently using the free-flow on-ramp from westbound Lakeland Hills Boulevard will now be routed through the traffic signal, requiring an additional westbound right turn lane to be added approaching the signal. The free-flow on-ramp will be removed. Therefore, the cost of widening for the additional receiving lane (see concepts and the construction cost estimate in **Appendix C**) and widening Lakeland Hills Boulevard to is also included in construction cost estimates for the additional turn lanes. The lane configuration will be further evaluated in the PD&E study. The construction cost of the additional turn lanes and the receiving lane is estimated to be $980,048.

3.1.6 SR 33

Existing conditions (2022) analyses showed that the westbound left turn and the westbound overall approach at the westbound ramp intersection operate at LOS E in the AM and PM.

Additionally, the eastbound left turn, eastbound approach, and the overall intersection at the eastbound ramp intersection with SR 33 all operate at LOS F in the PM. However, these deficiencies were addressed in 2021 when both ramp terminal intersections were signalized. No further short-term operational improvements are recommended at this interchange. The ultimate improvements include full interchange reconstruction, with roundabout intersections and widening of SR 33 to four lanes (FPID 430185-3). This project is expected to start construction in late 2024 as part of the Moving Florida Forward Infrastructure Initiative.

3.1.7 SR 570/Polk Parkway East

There are no at-grade intersections associated with this interchange, which is currently operating at an acceptable LOS. No short-term improvements are recommended.

3.1.8 SR 559

The westbound left turn, westbound approach, and overall intersection with the westbound ramps operate at LOS F in the AM and PM.

The overall intersection with the eastbound ramp operates at LOS E in the AM.

FDOT District One identified operational and safety deficiencies (See final Interchange Operational Analysis Report, March 2023) associated with the current interchange traffic control. Operational review of the I-4 westbound at SR 559 ramp terminal intersection has identified conflicts between northbound left and southbound right turning vehicles entering the I-4 westbound on-ramp and between I-4 westbound off-ramp left and SR 559 north/south through vehicles. The westbound off-ramp left-turn queues have been observed to extend beyond the existing turn lane, blocking right turn vehicles from entering the right turn lane. The westbound left turn experiences excessive delay during the peak hours and instances of queued vehicles extending back to the I-4 mainline. Many vehicles were observed bypassing the left-turn queue by using the ramp shoulder and right turn lane, making a right turn onto northbound SR 559, then immediately making a U-turn to head south on SR 559.

The eastbound off ramp volumes are similar to the westbound, however the majority of turning movements are right turns. Although right turns are made with less interference than left turns, the eastbound exit ramp is a single lane ramp that flares at SR 559 to provide approximately 30 feet of storage each for left and right turns and a queue of two left turn vehicles blocks right turn access. Additionally, sight distance for eastbound exit ramp vehicles looking north is limited due to the existing concrete barrier wall on the SR 559 bridge. Landscaping appears to contribute to the diminished sight distance. Left-turning vehicles must pull past the stop bar, blocking the southbound bike lane in order to see the oncoming traffic. See Safety section for short-term recommendations.

Traffic signals to be constructed at both intersections in Fiscal Year 2024 as part of a separate project (FPID 447436-2-52-01) are expected to improve the LOS and safety deficiencies.

3.1.9 SR 557

Construction of improvements to change the interchange configuration from a partial cloverleaf to a diamond with roundabouts at both ramp terminals was completed in early 2024 (FPID 201215-3-52-01). The changes were designed to improve traffic circulation and enhance safety, emergency access, and truck access, and to accommodate future ultimate improvements along I-4, including the rail corridor. However, the existing 2022 conditions traffic analysis summarized below was completed for the partial cloverleaf.

The westbound left turn, westbound approach, and overall intersection with the westbound ramps operate at LOS F in the AM and PM.

The eastbound left turn, eastbound approach, and the overall eastbound ramp intersection operate at LOS F in the AM.

The eastbound left and right turns, eastbound approach, and the overall eastbound ramp intersection operate at LOS F in the PM.

Short-term deficiencies were addressed with the construction of the new interchange configuration; therefore, no further improvements are recommended.

3.2 Operations Considerations and Recommendations for Mainline Segments

There are no operations recommendations for mainline segments. Concept sketches for potential improvements to be evaluated in a future PD&E study are included in **Appendix D**.

3.2.1 SR 570/Polk Parkway West to US 92/SR 546/W. Memorial Boulevard

The eastbound segment currently operates at LOS E and F in the AM and PM, respectively. An eastbound auxiliary lane would improve operations. Due to the frontage road located adjacent to I-4 on the south side, widening would need to occur in the median. An auxiliary lane between interchanges can be evaluated in the PD&E study. South Frontage Road is located adjacent to the eastbound I-4 lanes; therefore, any widening would need to occur into the median. Another consideration is that any widening may be complicated since the existing pavement is concrete, so maintaining acceptable cross slopes and alignment may require full reconstruction of the pavement. Also, the curved mainline alignment east of the Polk Parkway interchange may need to be adjusted to avoid or minimize design variations for the ultimate typical section, including general use lanes, express lanes, and the rail corridor in the median.

The westbound segment currently operates at LOS C in the AM and PM.

3.2.2 US 92/SR 546/W. Memorial Boulevard to SR 539/Kathleen Road

The eastbound segment currently operates at acceptable LOS D in both the AM and PM.

The westbound segment operates at LOS E and D in the AM and PM, respectively. Improvements are needed to this segment by 2027 to meet an acceptable LOS. A westbound auxiliary lane between interchanges can be evaluated in the PD&E study to determine if it would improve operations and fit within existing right-of-way and under the Swindell Road, West 10th Street, and West Bella Vista Street bridges.

3.2.3 SR 539/Kathleen Road to US 98

The eastbound segment currently operates at an acceptable LOS D in both the AM and PM.

The westbound segment currently operates at LOS E and D in the AM and PM, respectively. Improvements are needed to this segment by 2027 verify to meet an acceptable LOS. Due to the short distance between these two interchanges (2,270 feet painted gore nose to painted gore nose), the potential to extend the acceleration and deceleration lanes is limited. Therefore, an auxiliary lane connecting these ramps should be evaluated in both directions during the PD&E study.

3.2.4 US 98 to SR 33/Lakeland Hills Boulevard and North Socrum Loop Road

This segment currently operates at acceptable LOS D in both westbound and eastbound directions the AM and PM. Improvements are needed to this segment by 2030 verify to maintain an acceptable LOS. Auxiliary lanes in both directions can be evaluated in the PD&E study to extend the acceptable LOS past 2030.

3.2.5 SR 33/Lakeland Hills Boulevard and North Socrum Loop Road to SR 33

The eastbound segment currently operates at an acceptable LOS C in both the AM and PM. The westbound segment currently operates at an acceptable LOS D and C in the AM and PM, respectively. Improvements are needed to this segment by 2034 to maintain an acceptable LOS. Auxiliary lanes in both directions can be evaluated in the PD&E study if ultimate improvements are not programmed for construction by 2034.

3.2.6 SR 33 to SR 570/Polk Parkway East

The eastbound segment currently operates at an acceptable LOS C in both the AM and PM. The westbound segment currently operates at an acceptable LOS D and C in the AM and PM, respectively. Improvements are needed to this segment by 2037 verify to maintain an acceptable LOS. Auxiliary lanes in both directions can be evaluated in the PD&E study if ultimate improvements are not programmed for construction by 2037.

3.2.7 SR 570/Polk Parkway East to SR 559

The eastbound segment currently operates at an acceptable LOS C in both the AM and PM. The westbound segment currently operates at an acceptable LOS D and C in the AM and PM, respectively. Improvements are needed to this segment by 2034 to maintain an acceptable LOS. Auxiliary lanes in both directions can be evaluated in the PD&E study if ultimate improvements are not programmed by 2034.

3.2.8 SR 559 to SR 557

The eastbound segment currently operates at an acceptable LOS C in both the AM and PM. The westbound segment currently operates at an acceptable LOS D and C in the AM and PM, respectively. Improvements are needed to this segment by 2034 to maintain an acceptable LOS. Auxiliary lanes in both directions can be evaluated in the PD&E study if ultimate improvements are not programmed by 2034.

3.2.9 SR 557 to US 27

The eastbound segment currently operates at an acceptable LOS C in both the AM and PM. The westbound segment currently operates at an acceptable LOS D and C in the AM and PM, respectively. Improvements are needed to this segment by 2032 to maintain an acceptable LOS. Auxiliary lanes in both directions can be evaluated in the PD&E study if ultimate improvements are not programmed by 2032.

3.3 Operations Recommendations Construction Cost Summary

A summary of construction costs for the Operations recommendations is included in Table 3-1.

Table 3-1: Operations Recommendations Construction Cost

Improvement Location	Length (ft)	Length (mi)	Per Mile Model Unit Cost	Improvement Cost	Contingency	Total Cost
US 92/SR 546/W. Memorial Boulevard			**Rural Interstate Model 10**			
I-4 WB Deceleration Lane	1500	0.284	$1,017,259.79	$288,994.26	25%	$361,242.82
Kathleen Road			**Rural Interstate Model 10**			
I-4 WB Deceleration Lane	1500	0.284	$1,017,259.79	$288,994.26	25%	$361,242.82
US 98 Ramp Terminal			**Rural Arterial Model 9**			
Add left turn lane at EB I-4 off-ramp terminal intersection	960	0.182	$869,856.58	$158,155.74	25%	$197,694.68
SR 33/Lakeland Hills Boulevard and North Socrum Loop Road						
Lakeland Hills Blvd			**Rural Arterial Model 9**			
Add turn lanes (rural)	2850	0.540	$869,856.58	$469,524.86		
			Urban Arterial Model 10			
Add turn lanes (urban)	550	0.104	$3,019,327.00	$314,513.23		
			Lakeland Hills Blvd Total Cost:	$784,038.09	25%	$980,047.61
Socrum Loop Road			**Rural Arterial Model 9**			
Add turn lanes (rural)	1900	0.360	$869,856.58	$313,016.57		
			Urban Arterial Model 10			
Add turn lanes (urban)	500	0.095	$3,019,327.00	$285,921.12		
			Socrum Loop Rd Total Cost:	$598,937.69	25%	$748,672.11
			TOTAL			**$2,648,900**

4 Safety Recommendations

A safety analysis was performed and documented in the Phase 2 Crash Analysis Technical Memorandum (November 2022). The memo documents the analysis of historical crash data collected from the FDOT State Safety Office GIS Query Tool (SSOGis) and Signal 4 Analytics (S4) for the I-4 study corridor, including all nine interchanges and nine mainline segments. The segment west of the SR 570/Polk Parkway West interchange was not analyzed as a separate segment because the crash data was included and analyzed within the SR 570 West interchange study area. In general, areas of concern were identified in one of two ways: based on an observed crash rate that exceeded the districtwide average crash rate for similar facilities (documented in the study's Phase 2 Crash Analysis Tech Memo, dated November 2022), or if a crash hotspot/cluster was identified, especially one with reoccurring similar crash types. These areas of concern are discussed in the following sections if/where they have been identified. Following the review and analysis of crash data, safety improvement recommendations were developed and are presented below. These recommendations were developed based on the identification of specific crash trends and hotspots, with particular focus on reoccurring crash events of similar type and location that are potentially correctible by the implementation of proven countermeasures. When these locations were identified, all known potentially viable countermeasures were considered and a recommendation was developed that best suited the site needs and characteristics. In many cases, multiple options are available to address the safety need and should be further considered in subsequent phases of project development.

In general, continued resurfacing to maintain pavement and striping conditions will help preserve the safest operating conditions. Crash data heat maps are included in the Phase 2 Crash Analysis Technical Memorandum (November 2022, **Appendix F**). **Appendix G** includes 22 plan sheets depicting safety recommendations by location along the corridor, which are identified by alphanumeric designations A-1 through A-10. These recommendations are described below. **Appendix H** includes additional information and photos for each location. **Appendix I** includes cost estimates for the safety recommendations.

4.1 Safety at Interchanges, Ramps, and Cross Streets

The following subsections describe safety evaluations and recommendations for the study area's interchanges, including ramps and interchange cross streets.

FHWA's Handbook for Designing Roadways for the Aging Population (2014) indicates "A parallel (rather than a taper) design for entrance ramp geometry is recommended…" AASHTO recognizes the operational and safety benefits of long acceleration lanes provided by parallel type entrances. A long acceleration lane provides more time for merging drivers to find an opening in the through-traffic stream. A parallel style entrance lane length of at least 1,200 ft, plus a taper, is desirable."

The following existing on-ramps include taper-type merges with I-4 traffic without a parallel acceleration lane:

- SR 570/Polk Parkway West: eastbound
- US 92/SR 546/W. Memorial Boulevard: eastbound
- SR 539/Kathleen Road: eastbound and westbound
- US 98: westbound
- SR 33: eastbound and westbound
- SR 570/Polk Parkway East: westbound
- SR 559: westbound

There are no signs or pavement markings at any of these locations to warn the drivers entering I-4 that the lane ends abruptly, and they must quickly merge with I-4 traffic. Without a parallel-type acceleration lane, drivers must accelerate on the ramp and within the taper area. Historical crash data shows crash clusters at two of the on-ramps listed above (Memorial Boulevard eastbound and Kathleen Road eastbound). Predominant crash types at these locations are rear end collisions and off-road collisions, which can both be attributed to the short merge distances provided. The ultimate improvements to be evaluated in future PD&E studies will include parallel style entrance (acceleration) lanes at all locations or full auxiliary lanes from interchange to interchange to improve both safety and operations.

As an interim improvement, it is recommended that six-inch white skip stripes (3’-9’) with white/red reflective pavement markers (RPMs) be added at these existing on-ramp taper-type merge areas, in accordance with FY 2023-24 Standard Plans Index 711-003 (**Appendix G**).

4.1.1 SR 570/Polk Parkway West

A review of historical crash data at this interchange did not reveal any specific locations with reoccurring crash events of a correctible nature. The crashes varied in location, type, and roadway/weather conditions. However, most ramp crashes at this interchange occurred along the westbound on-ramp from Polk Parkway to I-4. The majority of these crashes (24 of 30) were attributed to driver error, either careless/negligent driving or driving too fast for conditions. Existing roadway signage approaching and along this ramp is generally well designed, with advance “reduce speed” warnings and multiple advisory 35 MPH speed signs and curve warning signage. Based on a review of crash data and existing conditions, the only recommendation at this interchange is for 365 feet of six-inch white skip stripes (3’-9’) with white/red reflective pavement markers (RPMs) be added to the eastbound on-ramp taper-type merge onto I-4, in accordance with FY 2023-24 Standard Plans Index 711-003 (Sheet 2 of 8) (**Appendix G**). There are no other safety recommendations at this interchange. The cost to add the skip stripes and RPMs is estimated to be $25,364 (**Appendix I**). No bike/ped features are present at this interchange.

4.1.2 US 92/SR 546/W. Memorial Boulevard

The review of crash data at this interchange revealed multiple westbound left-turn crashes at the westbound ramp terminal intersection. It is currently difficult to see the left-turn path guide lines through the intersections as they have been worn away over time. Short-term recommendations include restriping left-turn path lines and installation of retroreflective backplates on the signal heads for improved daytime and nighttime visibility. Retroreflective backplates help warn the driver of the presence of a signalized intersection and restriping the turn path lines help drivers maintain their lanes while making turns at the intersection. In addition, 600 feet of six-inch white skip stripes (3'-9') with white/red RPMs are recommended to be added to the eastbound on-ramp taper-type merge onto I-4 (See **Appendix G** and **Appendix H**, Location A-2). These enhanced pavement markings/RPMs will better notify drivers of the limited merge distance provided, where multiple off-road crashes have occurred that may have been attributable to the short merge distance. The cost to restripe the turn lanes and add signal backplates is estimated to be $31,779 (**Appendix I**). No bike/ped features are present at this interchange and none are recommended.

4.1.3 SR 539/Kathleen Road

The historical crash data at this interchange did not reveal any significant hotspots or reoccurring crashes of a similar nature. However, an evaluation of existing conditions warrants some short-term recommendations. It is recommended to install retroreflective backplates on the signal heads at both ramp terminal intersections. Additionally, left-turn path lines should be restriped at the eastbound ramp terminal intersection. In addition, a marked crosswalk should be added across the southbound to westbound on-ramp and the detectable surface should be replaced south of the westbound off-ramp terminal curb cut ramp. In addition, 700 feet of six-inch white skip stripes (3'-9') with white/red RPMs are recommended to be added to both eastbound and westbound on-ramp taper-type merges onto I-4 (See **Appendix G** and **Appendix H**, Location A-3). These enhanced pavement markings/RPMs will better notify drivers of the limited merge distance provided, where on the eastbound on ramp multiple rear end crashes have occurred that may have been attributable to the short merge distance. The cost of the improvements is estimated to be $54,841 (**Appendix I**).

4.1.4 US 98

The historical crash data at this interchange did not reveal any significant hotspots or reoccurring crashes of a similar nature. However, an evaluation of the existing conditions warrants some short-term improvements. Retroreflective backplates are recommended to be installed on all signal heads at the Single Point Urban Interchange (SPUI).

Bike lanes along US 98 within the interchange area are very narrow and vary in width. It is recommended to evaluate options to either widen, further separate, or increase visibility of the bike lanes. As an interim improvement, green-colored bike lane pavement markings through the

interchange were added to the construction cost. A slight reduction in travel lane width may be evaluated in the PD&E study given that all US 98 lanes, including turn lanes, are currently 12 feet in width through the interchange. A marked crosswalk is recommended to be added across the northbound to eastbound right turn entrance to the eastbound on-ramp. In addition, 600 feet of six-inch white skip stripes (3'-9') with white/red RPMs are recommended to be added to the westbound on-ramp taper-type merge onto I-4 (See **Appendix G** and **Appendix H**, Location A-5). The cost of the improvements is estimated to be $121,230 (**Appendix I**).

4.1.5 SR 33/Lakeland Hills Boulevard and North Socrum Loop Road

A review of crash data at this interchange revealed multiple crashes on the exit ramps, including several off-road crashes where vehicles may have been traveling at excessive speeds. The interchange ramps all include relatively tight horizontal curves. This is likely the leading contributing cause for the high frequency of crashes on the off-ramps as vehicles must slow down significantly from freeway speeds to navigate the curve.

Short term recommendations for the off-ramps include the addition of high friction surface treatment to aid in vehicle stability/traction while navigating the curves, and additional curve warning signage with advisory speed sign (W13-6, or similar) along the eastbound off ramp (the westbound ramp has adequate signage provided currently). Other potential options for consideration include radar feedback speed signs along the off ramps in advance of the curves. At the ramp terminal intersections, left-turn crashes from the cross streets onto the on-ramps were also common. It is recommended to restripe the left-turn paths at both ramp terminal intersections (see **Appendix G** and **Appendix H**, Location A-7). The cost of improvements at the eastbound ramps to/from Lakeland Hills Boulevard is estimated to be $424,985. The cost of improvements at the westbound ramps to/from Socrum Loop Road is estimated to be $431,473 (**Appendix I**). No bike/ped crash history currently warrants any additional bike/ped features at this interchange.

4.1.6 SR 33

Based on a review of the historical crash data, the main concern at this interchange was the I-4 mainline between the SR 33 ramps, where there was a high concentration of wet roadway and road departure crashes. A total of 16 off-road crashes were reportedly due to hydroplaning, with nine of those in the westbound direction inside travel lane. Most of the remaining off-road crashes involved vehicles that lost control for unknown reasons. Additional roadside guardrail may offer some safety benefit, but the primary concern here is loss of traction. Therefore, short term recommendations for the I-4 mainline here include the addition of 3,000 feet of high friction surface treatment in each direction to enhance friction/traction. A concrete pavement surface/texture evaluation is recommended for the bridge pavement, and if warranted, "Slippery When Wet" roadside signs are also recommended in each direction. In addition, 850 feet of six-inch white skip stripes (3'-9') with white/red RPMs are recommended to be added to both

eastbound and westbound on-ramp taper-type merges onto I-4 (See **Appendix G** and **Appendix H**, Location A-8). The cost of improvements at the SR 33 interchange is estimated to be $1,454,257 (**Appendix I**). No sidewalks exist along SR 33 currently, and no bike/ped crashes were observed in the data. The interchange is scheduled to be fully reconstructed in the near future to be converted to roundabout ramp terminal intersections. This project will provide bike/ped accommodations in accordance with FDOT standards.

4.1.7 SR 570/Polk Parkway East

A review of historical crash data at this interchange did not reveal any specific locations with reoccurring crash events of a correctible nature. The crashes varied in location, type, and roadway/weather conditions. However, nearly half of the crashes occurred during nighttime conditions. Therefore, a roadway lighting evaluation is recommended at this interchange. The ramps experiencing the most crashes at this interchange are the eastbound and westbound off-ramps to Polk Parkway. Minimal signage is currently provided along these ramps. Consideration of additional advisory speed signage and/or curve warning signage is recommended along these two ramps. Additionally, it is recommended to add approximately 590 feet of six-inch white skip stripes (3'-9') with white/red RPMs to the westbound on-ramp taper-type merge onto I-4 (See **Appendix G, Location A-9**). The cost of the skip striping is estimated to be $25,800 (**Appendix I**).

4.1.8 SR 559

The main issue at the SR 559 interchange based on the historical crash data review and field observations were the sight triangles for vehicles on the off-ramps. Due to the obtuse angle geometry of the stop-controlled right-turn lanes at both off-ramp terminals, it is difficult for drivers to turn their head to see oncoming traffic from the left. FDOT was previously notified about this issue by law enforcement, documented in an email dated April 1, 2020 (**Appendix J**). The sight triangle for westbound off-ramp drivers turning left is obscured by the barrier wall and fencing enclosing the sidewalk.

The sight triangle for eastbound off-ramp drivers turning left onto SR 559 is partially obscured by vegetation and the barrier wall and fencing enclosing the sidewalk which follows the crest curve profile geometry of the SR 559 overpass. It is approximately 127 feet from the driver's eye (stopped at the stop bar) to the face of the barrier wall. This is far less than the sight distance referenced in the FDOT Design Manual (FDM) Exhibit 212-6 (Four-lane divided/45 mph/median <30/Combined Vehicles). This results in the left-turning drivers pulling forward past the stop bar into the bike lane in order to see oncoming southbound traffic, which then obscures the sight triangle for other drivers turning right. In addition, the right turns include conflict points since they merge into the existing lane, without separate receiving lanes.

The existing posted speed along SR 559 is reduced from 55 miles per hour (mph) to 45 mph within the immediate vicinity of the interchange. However, field observations indicated that many drivers fail to significantly reduce their speeds through the interchange area, exacerbating the sight distance safety concern. High speeds are known to directly contribute to the severity of crashes. However, the planned/programmed signalization of the ramp terminals at this interchange should result in lower operating speeds and will also help resolve the sight distance issue as turning movements from the off-ramps will not operate concurrently with northbound/southbound through movements along SR 559.

The project to signalize the ramp terminal intersections is currently in the Final Design phase (FPID 447436-2-52-01) and is programmed for Construction in Fiscal Year 2025. Signalization will reduce conflicts and generally improve safety. In the meantime, it is recommended that the first Crepe Myrtle tree nearest to the eastbound off-ramp be removed immediately to improve the sight distance. Reconstructing this eastbound ramp at a higher elevation approaching the intersection would improve the sight distance, but the planned signalization of the intersection will improve safety by providing protected turning movements. Therefore, reconstruction is not recommended at this time.

Only one pedestrian crash occurred in the dataset, which involved a person illegally walking in the travel lanes. No bicycle or pedestrian improvements are currently recommended. The planned signalization of the ramp terminals will provide protected crossings at both intersections.

Lastly, approximately 790 feet of six-inch white skip stripes (3’-9’) with white/red RPMs are recommended to be added to the westbound on-ramp taper-type merge onto I-4 (see **Appendix G** and **Appendix H**, Location A-10). The cost of improvements at the SR 559 interchange is estimated to be $32,123 (**Appendix I**).

4.1.9 SR 557

Reconstruction of the SR 557 interchange was completed in March 2024 to replace the partial cloverleaf interchange with a new diamond configuration with roundabouts. The new interchange was designed to improve traffic circulation and enhance safety, emergency access, and truck access. Safety and operational improvements included:

- Widening of SR 557 from two to four travel lanes through the interchange,
- The two-lane bridge over I-4 was replaced with a four-lane bridge,
- Roundabouts were constructed at the I-4 on-ramps and off-ramps,
- Emergency stopping sites and new roadway lighting were installed.

Therefore, no short-term improvements are recommended at this interchange.

4.2 Safety on Mainline Segments

4.2.1 SR 570/Polk Parkway West to US 92/SR 546/W. Memorial Boulevard

Based on LOS E and F operations along this segment of I-4, indicating higher vehicle densities during peak periods, it is recommended that "Be Prepared to Stop" Variable Message Signs be installed to warn drivers of stopped traffic (See **Appendix G** and **Appendix H**, Location A-1). The cost of the signs is estimated to be $28,858 (**Appendix I**).

4.2.2 US 92/SR 546/W. Memorial Boulevard to SR 539/Kathleen Road

Based on a review of the crash data, no specific hotspots or reoccurring crash events of a similar nature were identified in this mainline segment, so no safety improvements are recommended.

4.2.3 SR 539/Kathleen Road to US 98

Based on the relatively tight spacing between these two interchanges (2,270 feet westbound, 2,710 feet eastbound gore to gore), the ability to extend the acceleration and deceleration lanes for these ramps is limited; therefore, auxiliary lanes in both directions should be evaluated during the PD&E study to provide a longer distance for vehicles to merge/diverge (see **Appendix G** and **Appendix H**, Location A-4). This suggestion is also included for evaluation in the PD&E study as part of the Operations Considerations for PD&E Study (**Appendix D**). The additional lane would provide a longer distance for drivers to adjust their speed and safely merge into the flow of traffic. However, an auxiliary lane would also introduce a new weave condition. These factors should be further evaluated in the PD&E Study.

4.2.4 US 98 to SR 33/Lakeland Hills Boulevard and North Socrum Loop Road

Based on a high density of wet roadway crashes along the short segment of I-4 around the Carpenters Way bridge, it is recommended that a high friction surface treatment be installed in each direction for 750 feet on each side of the bridge (see **Appendix G and Appendix H**, Location A-6). The cost of improvements is estimated to be $740,593 (**Appendix I**).

4.2.5 SR 33/Lakeland Hills Boulevard and North Socrum Loop Road to SR 33

Based on a review of the crash data, no specific hotspots or reoccurring crash events of a similar nature were identified in this mainline segment, so no safety improvements are recommended.

4.2.6 SR 33 to SR 570/Polk Parkway

Based on a review of the crash data, no specific hotspots or reoccurring crash events of a similar nature were identified in this mainline segment, so no safety improvements are recommended.

4.2.7 SR 570/Polk Parkway East to SR 559

Based on a review of the crash data, no specific hotspots or reoccurring crash events of a similar nature were identified in this mainline segment, so no safety improvements are recommended.

4.2.8 SR 559 to SR 557

Based on a review of the crash data, no specific hotspots or reoccurring crash events of a similar nature were identified in this mainline segment, so no safety improvements are recommended.

4.2.9 SR 557 to US 27

Based on a review of the crash data, no specific hotspots or reoccurring crash events of a similar nature were identified in this mainline segment, so no safety improvements are recommended.

4.3 Safety Improvements Construction Cost Summary

A summary of construction costs for the Safety recommendations is included in Table 4-1.

Table 4-1: Safety Recommendations Construction Cost

Safety Recommendations Construction Cost	
Interchanges	
Polk Parkway West	$25,363.89
Memorial Boulevard	$31,779.16
Kathleen Road	$54,840.66
US 98	$121,229.73
Lakeland Hills Boulevard	$424,985.38
Socrum Loop Road	$431,473.42
SR 33	$1,454,257.06
Polk Parkway East	$25,799.79
SR 559	$32,123.43
Interchange Total	**$2,601,853**
I-4 Segments	
Polk Parkway West to Memorial Boulevard	$28,858.12
US 98 to Lakeland Hills Blvd/Socrum Loop	$740,593.06
Segment Total	**$769,451**
Total Safety Cost	**$3,371,304**

4.4 Total Interim Improvement Construction Costs

Total construction costs for operations and safety are shown in Table 4-2.

Table 4-2: Total Interim Improvement Construction Costs

Operations Recommendations Construction Cost	$2,648,900
Safety Recommendations Construction Cost	$3,371,304
Total Construction Cost	**$6,020,204**

5 Future Projects

Table 5-1 shows a preliminary list of potential future individual ultimate improvement projects for the I-4 corridor. Additional interim projects will be programmed based on the information and recommendations included in this report as funding becomes available.

Table 5-1: Future Projects

Interchange Projects		
Project Name	**Improvement Type**	**Year of Failure**
US 98 Interchange	TBD	2034
Socrum Loop Rd./Lakeland Hills Blvd. Interchange	TBD	2022
Mainline Projects		
Project Name	**Length (miles)**	**Year of Failure**
West of SR 570/Polk Parkway (West) to East of US 98	7.0	2023
East of US 98 to West of SR 570/Polk Parkway (East)	7.5	2030
West of SR 570/Polk Parkway (East) to West of US 27	13.5	2034

Appendices

Appendix A: Revised Draft Build Alternatives Traffic Analysis Memo

Appendix B: Operations Recommendations Concept Plan Sheets

Appendix C: Operations Recommendations Cost Estimates

Appendix D: Operations Considerations for Evaluation in PD&E Study

Appendix E: Vissim Analysis Report

Appendix F: Phase 2 Crash Analysis Technical Memorandum

Appendix G: Safety Recommendations Concept Plan Sheets

Appendix H: Safety Recommendations Photos

Appendix I: Safety Recommendations Cost Estimates

Appendix J: SR 559 Interchange Sight Distance Email